

Unit Review - Probability

Vocab and Basics

- Events that do not affect each other are called independent events.
- In probability, any outcome other than the desired outcome is called a (failure/success).
- The sum of the probability of an event and the probability of the complement of the event is always (0/1).
- The odds of an event occurring is the ratio of the number of ways the event can succeed to the sum of the number of total outcomes.
- The arrangement of objects in a certain order is called a permutation.
- Two mutually exclusive events cannot happen at the same time.
- A sample space is the set of all possible outcomes of an event.

Practice Problems

- How many different ways can three books be arranged in a row on a shelf?

$${}_3P_3 = 6$$

- How many ways can six teachers be assigned to teach six different classes, if each teacher can teach any of the classes?

$${}_6P_6 = 720$$

- A box contains slips of paper numbered from 1 to 14. One slip of paper is drawn at random. Find each probability.

- P(a prime number or a multiple of 4)

2, 3, 5, 7, 11, 13

4, 8, 12

$$\frac{6}{14} +$$

$$\frac{3}{14} =$$

$$\frac{9}{14}$$

- P(a multiple of 2 or a multiple of 3)

2, 4, 6, 8, 10, 12, 14

3, 6, 9, 12

$$\frac{7}{14} +$$

$$\frac{4}{14} -$$

$$\frac{2}{14} =$$

$$\frac{9}{14}$$

- P(a 3 or a 4)

$$\frac{2}{14} =$$

$$\frac{1}{7}$$

- P(a number less than or equal to 8)

$$\frac{8}{14} =$$

$$\frac{4}{7}$$

11. A bag contains 7 pennies, 4 nickels, and 5 dimes. Three coins are drawn at random. Find each of the following. *16 total*

a. P(3 pennies)

$$\frac{{}^7C_3}{{}^{16}C_3} = \frac{35}{560} = \frac{1}{16} \quad \text{or} \quad \frac{7 \cdot 6 \cdot 5}{16 \cdot 15 \cdot 14} = \frac{210}{3360} = \frac{1}{16}$$

b. P(2 pennies, 1 nickel)

$$\frac{{}^7C_2 \cdot {}^4C_1}{{}^{16}C_3} = \frac{21 \cdot 4}{560} = \frac{84}{560} = \frac{3}{20} \quad \text{or} \quad \frac{7}{16} \cdot \frac{6}{15} \cdot \frac{4}{14} \cdot 3 = \frac{504}{3360} = \frac{3}{20}$$

c. P(3 nickels)

$$\frac{{}^4C_3}{{}^{16}C_3} = \frac{4}{560} = \frac{1}{140} \quad \text{or} \quad \frac{4 \cdot 3 \cdot 2}{16 \cdot 15 \cdot 14} = \frac{24}{3360} = \frac{1}{140}$$

d. Odds of picking 3 pennies 1:15

e. Odds of picking 2 pennies and 1 nickel 3:17

f. Odds of picking 3 nickels 1:139

12. Determine if each pair of events is independent or dependent. Then find the probability.

a. Selecting two yellow markers from a box that contains 4 yellow and 6 pink markers.

Dependent $\frac{{}^4C_2}{{}^{10}C_2} = \frac{6}{45} = \frac{2}{15}$

b. Rolling a six then rolling an even number when rolling a standard dice twice.

Independent $\frac{1}{6} \cdot \frac{3}{6} = \frac{3}{36} = \frac{1}{12}$

13. A clothing store sells belts in 3 colors, 4 designs, and 6 sizes. How many different belts are available?

$$3 \cdot 4 \cdot 6 = 72$$

14. Twelve runners are in a track race. How many different ways can first, second, and third place be awarded?

$${}_{12}P_3 = 1320$$

15. Five players will be chosen from a group of 15 students. How many different 5-person teams can be formed?

$${}_{15}C_5 = 3003$$

16. The odds of an event occurring are 4 to 7. What is the probability that the event will occur?

$$\frac{4}{11}$$

17. A die is rolled 3 times. Find P(no 5s).

$$\frac{5}{6} \cdot \frac{5}{6} \cdot \frac{5}{6} = \frac{125}{216}$$

18. Two cards are drawn from a standard deck of 52 cards without replacement. Find the probability that the first card is an ace and the second is a 2.

$$\frac{4}{52} \cdot \frac{4}{51} = \frac{16}{2652} = \frac{4}{663}$$

19. From a group of 6 men and 8 women, a committee of 3 is selected. Find the probability that all 3 are men or all 3 are women.

$$\frac{{}^6C_3}{{}^{14}C_3} + \frac{{}^8C_3}{{}^{14}C_3} = \frac{20 + 56}{364} = \frac{76}{364} = \frac{19}{91}$$

20. Each of the numbers 1 to 25 is written on a card and placed in a bag. If one card is drawn at random, what is the probability that it is a multiple of 4 or a multiple of 5?

$$4, 8, 12, 16, 20, 24 \quad 5, 10, 15, 20, 25$$

$$\frac{6}{25} + \frac{5}{25} - \frac{1}{25} = \frac{10}{25} = \frac{2}{5}$$

21. If the probability of rain in a certain city is $\frac{1}{8}$ on any given day, find the probability that rain will fall on exactly one day of a three-day visit to the city.

$$\frac{1}{8} \cdot \frac{7}{8} \cdot \frac{7}{8} + \frac{7}{8} \cdot \frac{1}{8} \cdot \frac{7}{8} + \frac{7}{8} \cdot \frac{7}{8} \cdot \frac{1}{8} = \frac{147}{512}$$

22. Find the probability of picking a spade or a 4 when taking a single card from a deck.

$$\frac{13}{52} + \frac{4}{52} - \frac{1}{52} = \frac{16}{52} = \frac{4}{13}$$

23. Find the number of distinct rearrangements of the word CAREER.

$$\frac{{}^6P_6}{2!2!} = \frac{720}{4} = 180$$

24. Find the probability of choosing the letter "I" from the word PROBABILITY.

$$\frac{2}{11}$$

25. A bowl of fruit has 2 grapefruit, 10 clementines and 4 apples. If you pull two pieces of fruit from the bowl, find the following:

a. P(grapefruit, clementine) $\frac{2}{16} \cdot \frac{10}{15} = \frac{20}{240} = \frac{1}{12}$

b. P(2 clementines) $\frac{10}{16} \cdot \frac{9}{15} = \frac{90}{240} = \frac{3}{8}$ or $\frac{{}^{10}C_2}{{}^{16}C_2}$

26. You put the numbers 1-10 in a hat, pick a number, put it back, and then pick another number. Find the following:

a. P(1,1) $\frac{1}{10} \cdot \frac{1}{10} = \frac{1}{100}$

b. P(even, 4) $\frac{5}{10} \cdot \frac{1}{10} = \frac{5}{100} = \frac{1}{20}$

c. P(prime, odd) $\frac{4}{10} \cdot \frac{5}{10} = \frac{20}{100} = \frac{1}{5}$

$$\frac{4}{10} \cdot \frac{5}{10} = \frac{20}{100} = \frac{1}{5}$$

27. You flip a coin 4 times. Find the probability that it lands on heads each time.

$$\frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} = \frac{1}{16}$$

28. A family has 3 children. Find the probability that they had a boy, then a girl, then another girl.

$$\frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} = \frac{1}{8}$$

B G G

29. In a primary election there are four candidates for mayor, five for city treasurer, and two for county attorney. In how many different ways may voters mark their ballots?

$$4 \cdot 5 \cdot 2 = 40 \text{ ways}$$

30. How many distinct rearrangements are there of the word BUCKET if the first letter must be a T?

$$\underline{1} \cdot \underline{5} \cdot \underline{4} \cdot \underline{3} \cdot \underline{2} \cdot \underline{1} = 120$$

31. Find the probability of rolling a 2 or an even number on a standard die.

$$\frac{3}{6} = \frac{1}{2}$$

2 2 4 6

32. Give an example of two things that are inclusive.

Junior + girl, heart + 6, even + prime

33. Give an example of two things that are mutually exclusive.

even + odd, girl + boy,

34. Give an example of two independent events.

picking two things with replacement
rolling a die twice

35. Give an example of two dependent events.

picking two things without replacement

36. I am guessing on a quiz with 4 true/false questions and 6 multiple choice questions, each of which has four possible answer choices. How many different ways are there to answer the 10 question quiz?

$$\underline{2} \cdot \underline{2} \cdot \underline{2} \cdot \underline{2} \cdot \underline{4} \cdot \underline{4} \cdot \underline{4} \cdot \underline{4} \cdot \underline{4} \cdot \underline{4} = 65,536 \text{ ways}$$

T/F MC